REMARKS

By the present Amendment, typographical revisions have been made throughout the specification and the claims have been amended to define certain aspects of the present invention with greater precision and to correct typographical errors in certain formulas. More specifically, claim 1 has been amended to recite that the crosslinkable group is at least one selected from the group consisting of i) a crosslinkable group composed of a C_1 to C_{10} alkyl group bonded to the aromatic ring and a carbonyl group, ii) a carbon-carbon double bond, and iii) a carbon-carbon triple bond. This recitation is supported by the specification such as on pages 25 and 26 and various modifications in the dependent claims have been implemented in light of amended claim 1. Claim 1 additionally recites that the crosslinkable group is not derived from the protonic acid group and can form a polymer network without forming an elimination component. This enables the production of an ion conductive polymer membrane, binder or electrode for fuel cells which have high ion conductivity and are excellent in heat resistance, water resistance and adhesion property. By requiring that the crosslinkable group is not derived from the protonic acid group and can form a polymer network without forming any elimination component, crosslinking can be attained without degeneration or deterioration of electrode materials, a uniform crosslinking density in the thickness direction can be obtained and the formation of thick membranes without generating gas that is corrosive to manufacturing equipment can be achieved.

As can be understood from the discussion provided on pages 1-10 of the specification, when crosslinkable groups are used that are derived from a protonic acid group and provide an elimination component, substantial disadvantages can be encountered. In particular, removal of the elimination components becomes

necessary, the crosslinking density can be different between the membrane surface and the inside or back surface of the membrane, membrane thickening is achieved only with difficulty, voids can be formed on the membrane and corrosion problems due to generated acidic gas can occur.

The claims now of record are neither anticipated by nor obvious over the cited prior art. Published PCT Application No. WO 96/29359 relates to polymer electrolytes and a process for their production. The polymer is a sulfonated aromatic polyether ketone of a defined formula which contains certain aromatic groups which can be substituted. However, the '359 publication does not describe a crosslinkable group as defined in the claims now of record, such as a crosslinkable group composed of a C_1-C_{10} alkyl group bonded to the aromatic ring in combination with a carbonyl group. Thus, the '359 publication cannot be used to reject the claims now of record.

The article by F. Wang et al entitled "Sodium sulfonate-functionalized poly(ether ether ketone)s" describes the preparation of poly(ether ether ketone)s containing sodium sulfonate groups that are synthesized via aromatic nucleophilic substitution by the reaction of sodium 5,5'-carbonylbis(2-fluorobenzenesulfonate) and Bisphenol A in the presence of potassium carbonate in dimethyl sulfoxide. In the conclusion on page 1425, the article states that the functionalized polymers were found to possess a higher glass transition temperature than corresponding unsubstituted polymers and to possess good thermal stability and indicates that work on water vapor and gas permeation behaviors, and ion selectivities through membranes prepared from the functionalized polymers was currently under investigation.

The article by Wang et al does not disclose a crosslinkable aromatic resin as recited in the claims now of record with the defined crosslinkable group and meeting the recitation that it can form a polymer network without forming any elimination component. In this respect, the Examiner's attention is respectfully directed to the discussion of sulfonated polyetherether ketones that is set forth on pages 8 and 9 of the specification which distinguishes such type of polymers.

Yen et al, U.S. Patent No. 5,795,496, relates to polymeric materials for electrolytic membranes in fuel cells. The polymers are a sulfonic-acid containing polymer that is preferably based on polyetherether ketone or p-phenylene ether sulfone. A discussion of the preferred polymer materials is provided in the passage beginning at column 6, line 12 and at column 7, lines 20-37, wherein the patent describes a crosslinking method in which sulfonic acids in a sulfonated polyetherether ketone membrane are condensed by disulfuric acid to form sulfonate bonds. Additional crosslinking mechanisms are described in the passage at column 10, lines 34-54. Such mechanisms involve the elimination of sulfuric acid, hydrochloric acid, chlorine, etc. and have the problem that the crosslinking density of the membrane surface is different from that of the inside or back surface of the membrane, membrane thickening is difficult, voids can be formed on the membrane and corrosion can occur due to the elimination of acidic gas, as mentioned above and in the background of the present application. Accordingly, Yen et al does not describe a crosslinkable group that is not derived from a protonic acid group without forming any elimination component as defined in the claims of record, much less the specifically recited crosslinkable groups and therefore also does not negate the patentability of the presently claimed invention.

Mao et al, U.S. Patent No. 6,090,895, describes a method for making crosslinked acidic polymers useful as ion conductive membranes, such as crosslinked sulfonated polyether ketones, sulfonated polysulfones, sulfonated polystyrenes, and other acidic polymers, by crosslinking with a species that generates an acid functionality. As such, Mao et al would lead those of ordinary skill in the art directly away from the presently claimed invention which recites that the crosslinkable group is not derived from the protonic acid group, and can form a polymer network without forming any elimination component. Indeed, when one considers the express teachings of Mao et al with those of the other prior art, it is evident that those of ordinary skill in the art would be directed away from the presently claimed invention. As such, Mao et al would add to the patentability of the present invention, rather than detract from it.

For all of the reasons set forth above, applicants respectfully submit that the claims now of record are neither anticipated nor rendered obvious by the cited prior art and therefore request reconsideration and allowance of the present application.

Should the Examiner wish to discuss any aspect of the present application, he is invited to contact the undersigned attorney at the number provided below.

Respectfully submitted,

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